Length of Pile feet (m)	Tip Diameter inches (mm)	Diameter, 4 feet (1.2 m) from Butt, inches (mm) Southern Yellow Pine Southern Cypress Douglas Fir	All Other Species
#21(6.3)	9(299)	11(279)	11(279)
21-40(6.4-12.4)	8(203)	12(305)	13(330)
41-60(12.5-18.3)	7(178)	13(330)	14(356)
>60(18.3)	6(152)	14(356)	14(356)

Diameter of the piles at the butt shall not exceed 18 inches (457 mm).

(b) **Storing and Handling.** The method of storing and handling shall be such as to avoid injury to the piles. Special care shall be taken to avoid breaking the surface of treated piles, and cant dogs, hooks or pike poles shall not be used.

Cuts or breaks in the surface of treated piling shall be given 3 brush coats of hot creosote oil of approved quality, and hot creosote oil shall be poured into all bolt holes.

SECTION 730
PAINT FOR STRUCTURAL STEEL

730.01. GENERAL REQUIREMENTS.

(a) **Scope.** This Section covers the various types of paint used to protect structural steel.

(b) **Certification.** For each shipment of paint, furnish a Type C certification in accordance with Subsection 106.04, for each lot of each paint. Only paint systems included on the Materials Engineer's list of approved products shall be used on Department projects.

For a paint system to be considered for inclusion on the list of approved products, the paint manufacturer shall submit a Type A certification showing satisfactory test results from an approved testing laboratory. The certification shall include the manufacturer's name, system performance test results and dates; it will also show the following for each paint: test results and dates, brand name, lot number, and date of manufacture. New certification shall be required if any of the following conditions occur: the manufacturing process or paint formulation is changed, testing indicates nonconformance to the Specifications, or the certification is older than 5 years.

A 1 gallon (4 liter) sample of each component in a paint system may be required by the Engineer for testing purposes. In case of variance, the Department's test results will govern. Failure to meet Specification requirements will be grounds for removal from the list of approved products.

The Department reserves the right to suspend approval of products if paint system performance is unsatisfactory (i.e., the paint has poor durability or appearance).

(c) **System Performance.** Paint shall be evaluated according to Performance Class. The performance of the coating system shall be measured using test panels. These test panels shall be coated with all required paint coats. Each coat shall be applied as specified.

1. ***Performance Class 1.*** Performance Class 1 coating systems shall be tested as follows: Three test panels shall be made for each of the specified tests; the test panels shall be prepared as described in AASHTO M300; and, where applicable, blistering shall be rated by ASTM D714.
   1.1. ***Fresh Water Resistance.*** Fresh water resistance testing shall conform to the requirements of ASTM D870. Panels shall be scribed in accordance with AASHTO M300 for Salt Fog Resistance and then immersed in fresh tap water at 75±5°F (24 ± 3° C). After 30 days of immersion, the panels shall not show any rusting, nor shall the coating show any blistering, softening, or discoloration.

   1.2. ***Salt Water Resistance.*** Salt water resistance testing shall conform to the requirements of ASTM D870. Panels shall be scribed in accordance with AASHTO M300 for Salt Fog Resistance and then immersed in a solution of water and 5% sodium chloride at 75±5°F (24 ± 3° C). After 30 days of immersion, the panels shall not show any rusting, nor shall the coating show any blistering, softening, or discoloration. Panels shall be rated at 7, 14, and 30 days. The saline solution shall be replaced with fresh saline solution after the 7 and 14 day examinations.

   1.3. ***Salt Fog Resistance.*** Panels shall be tested as described in AASHTO M300 for Salt Fog Resistance except that the exposure will be 2,500 continuous hours.

   1.4. ***Weathering Resistance and Specular Gloss.*** Weathering resistance testing shall conform to the requirements of ASTM D4587, Method D, utilizing UVA 340 bulbs. Testing of the panels shall start at the beginning of a wet cycle. After 3,000 hours continuous exposure, the coating shall not show any blistering or loss of adhesion, nor shall the panels show any rusting.

   The 60° specular gloss measurements shall be performed on the sprayed panels utilized for the weathering resistance test. The initial specular gloss measurements (one from each panel) shall be averaged together. The final specular gloss measurements shall also be averaged together.

   1.5. ***Elcometer Adhesion Test.*** Elcometer adhesion testing shall conform to the requirements of ASTM D4541. The panels shall be tested using an adhesion tester 1000 psi (6.9 MPa) in accordance with the following: the coating surface and aluminum dolly shall be lightly sanded and a quick-set adhesive applied; the adhesive is cured overnight; the coating and adhesive around the dolly is scribed before testing; and a minimum of three trials is made and reported.

   For a paint to be acceptable, each trial must have adhesion of 400 psi (2.76 MPa) or more and show no evidence of fracture at the primer-blast interface.

2. **Performance Class 2.** Performance Class 2 coating systems shall be tested as follows: Three test panels shall be made for each of the specified tests; the test panels shall be prepared as described in AASHTO M300. Where applicable, blistering shall be rated by ASTM D714 and rusting in accordance with ASTM D610.
   2.1. ***Salt Fog Resistance***. Panels shall be tested as described in AASHTO M300 for Salt Fog Resistance except that the exposure will be 1,000 continuous hours.

   2.2. ***Prohesion.*** Panels shall be tested for 2,000 hours in accordance with ASTM G 85, Appendix A5. The electrolyte solution for the cyclic fog/dry test shall consist of a

Timmins solution: 0.40 wt% $(NH_4)_2SO_4$ with 0.05 wt%NaCl. The temperature shall be maintained at 100°F (38°C) during the fog/dry cycles. Any test panels having rust spots, blisters, or undercutting at the scribe will be considered a failure.

2.3. ***Fluorescent UV.*** Test for 2,000 hours in accordance with ASTM G53 (8 hours UV at 160°F (71°C) followed by four hours condensation at 120°F(49°C)). Any test panels with rust spots, blisters, or undercutting at the scribe will be considered a failure.

Additionally, the paint system shall have at least three years of satisfactory performance (less than 1% of the painted surface shows visible rust, rust breakthrough, paint blistering, peeling, or scaling) in a bridge environment. Case histories from at least five bridge projects shall be included in the Type A certification data.

(d) **Containers and Labeling.** All paint furnished under these Specifications shall be supplied in strong, tight, approved containers. Each container shall be labeled with the manufacturer's name, paint type, Volatile Organic Compounds (VOC) content, date of manufacture, lot number, mixing instructions, and equipment cleanup instructions. Labels shall be sufficiently weather resistant to withstand one year of outdoor storage exposure without deterioration or fading.

If not affixed to the paint containers, Material Safety Data Sheets and Product Data Sheets shall be supplied with each paint shipment. Copies of both sheets shall be posted on the project site and submitted to the Resident Engineer prior to painting.

(e) **Toxic Substance Restriction.** Lead paint, or similar coatings containing lead or lead compounds, in which the lead content (calculated as lead metal) is in excess of 0.19% by mass of the total nonvolatile content of the paint or the mass of the dried paint film shall not be used on Department projects.

Paints containing asbestos or containing leachable hazardous elements in the dry paint film exceeding the limits shown below when tested using the Toxicity Characteristic Leaching Procedure (TCLP), 40 CFR 261, "Identification and Listing of Hazardous Waste," shall not be used on Department projects. The TCLP test shall be included in the Type A certification.

Arsenic, ppm	5.0
Barium, ppm	100.0
Cadmium, ppm	1.0
Chromium, ppm	5.0
Lead, ppm	5.0
Mercury, ppm	0.2
Selenium, ppm	1.0
Silver, ppm	5.0

(f) **VOC Limitation.** The maximum permissible Volatile Organic Compound (VOC) level in any paint used for Department projects shall be 2.9 lb/gal (350 g/l) as thinned for application. VOC is defined as any organic compound which has a vapor pressure of .0019 psi (13 Pa) absolute or greater at standard condition. Lower VOC limits may be specified in the plans depending on project location. When shop painting is done, be aware that VOC regulations could be stricter than required by the Department. The Contractor shall comply with the most severe VOC regulations applicable.

(g) **Color.** Unless otherwise specified on the plans, the color of the coatings shall be as follows: the topcoat shall be light gray, Federal Standard No. 595A-16440, except for weathering steel, in which

case the topcoat shall be dark brown, Federal Standard No. 595A-10075. The primer and intermediate coats shall be colored so that each layer is clearly distinguishable from the other.

730.02. REQUIREMENTS FOR PAINT SYSTEMS.

(a) **Inorganic Zinc/Epoxy/Urethane (IZ-E-U) System.** The IZ-E-U system shall comply with the system performance requirements for Performance Class 1. This system shall produce a tough, durable film of minimum 9 mils (230 µm) dry film thickness, each coat well bonded to the previous layer. Prepare each surface and apply paint in such a manner to assure bonding of each coat. Cure each coat according to the manufacturer's recommendations prior to further coating. The dry film thickness of an individual coat shall be within -0.5/+2.0 mils (-15/+50 µm) of the specified coat thickness.

1. ***Inorganic Zinc-Rich (IZ) Primer.*** The first coat shall be an IZ primer conforming to the requirements of AASHTO M300, Type IA and the following: the primer shall have a Class B classification, with a minimum slip coefficient of 0.50, as tested by the "Test Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints" from the Research Council on Structural Connections. (See Appendix A of Allowable Stress Design Specification for Structural Joints Using ASTM A325 or A490 Bolts, published by the Research Council on Structural Connections.)

   Immediately prior to the application of the IZ primer, prepare the steel surface by the Steel Structure Painting Council's preparation specification SSPC-SP10, Near-White Blast Cleaning. For new steel, the surface profile shall be 1 to 3 mils (25 to 75 µm) as determined by ASTM D4417, Method A, B, or C. For new structural steel, the IZ primer shall be applied in the shop. The dry film thickness of the IZ primer shall be 3 mils (80 µm).

2. ***Epoxy (E) Intermediate Coat.*** The epoxy-polyamide paint intermediate coat shall be applied over IZ primer-coated steel in plan position on the project and shall conform to the following requirements:

Epoxy (E) Intermediate Coat

Pot Life	4 hours, minimum	SSPC Paint 22, Para. 5.5
Dry Through Time, 75°F (24°C), 45%R.H.	24 hours, maximum	ASTM D 1640
Fineness of Grind, Hegman Units	3.0, minimum	ASTM D 1210
Solvent Resistence	(see test method)	SSPC Paint 22, Para. 5.6
Test Panels	(see test method)	SSPC Paint 22, Para. 5.7
Elcometer Adhesion Test	(see test method)	SSPC Paint 22, Para. 5.8
Salt Spray Resistance	(see test method)	SSPC Paint 22, Para. 5.9
Dry Film Thickness	4 mils(100µm)	See Subsection 512.04(b)4

3. ***Urethane (U) Topcoat.*** The two-package, aliphatic urethane paint top coat shall conform to the requirements of the most recent edition of the Steel Structures Painting Council SSPC-PS Guide No. 17.00. The paint shall have a minimum 2-hour usable pot life at 77°F (25E C), and a maximum 4-hour dry-to-touch time at 77°F (25E C). The U topcoat shall be applied over E intermediate coat. The urethane topcoat also shall conform to the following requirements:

Urethane (U) Topcoat

Characteristic	Value	Test Method
Solids by weight	67%, minimum	ASTM D 1644
Solids by volume	54%, minimum	ASTM D 1644
Specular Gloss, 60°	85% minimum after drying, 70% minimum after 3,000 hours of weathering resistance testing	ASTM D 4587, Method D
Dry Film Thickness	2 mils(50 µm)	See Subsection 512.04(b)4

(b) **Single-Component Moisture-Cured Urethane (SC-MC-U) System.** The SC-MC-U system shall comply with the system performance requirements for Performance Class I. This system shall produce a tough, durable film of minimum 10 mils (0.25 mm) film thickness, each coat well bonded to the previous layer. Prepare each surface and apply paint in such a manner to assure bonding of each coat. Cure each coat according to the manufacturer's recommendations prior to further coating. The dry film thickness of each coat shall be within -0.5/+2.0 mils (-15/+50 µm) of the specified coat thickness.

The first coat shall be either a zinc-rich or zinc/MIO primer. The primer shall be formulated with other synthetic or natural MIO. If appoved, the primer may be two component. The intermediate coat and topcoat shall be formulated with natural micaceous iron oxide (MIO). The MIO intermediate coat shall be a SC-MC-U paint. The topcoat shall be a MIO-based SC-MC-Aliphatic-U paint. The SC-MC-U paint coats shall be formulated as follows:

	Zinc-Rich Primer	Zinc/MIO Primer	MIO Intermediate Coat	MIO Topcoat
Minimum Zinc Powder (mixed paint)	78% by weight	--	--	--
Minimum MIO Content	--	--	4lb/gal	--
	--	--	(6.87kg/l)	--
Minimum Solids (mixed paint)	60% by volume	60% by volume	60% by volume	53% by volume
Pigment Type	zinc dust	zinc dust & MIO	--	--
Minimum Weight/Volume (mixed paint)	23 lb/gal (39.5 kg/l)	19 lb/gal (32.6 kg/l)	12 lb/gal (20.6 kg/l)	11 lb/gal (18.89 kg/l)
Minimum Zinc Content (dry film)	86% by weight	--	--	--
Dry Film Thickness	3.5 mils (89µm)	3.5 mils (89µm)	3.5 mils (89µm)	3 mils (76µm)

(c) **Repair Paint Systems.** The coating system for Category R applications as defined in Subsection 512.04(b)2 shall comply with Performance Class 2 requirements. The system may be comprised of one to three coats, but one coat systems may only be used when permitted in the plans.